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## ARTICLE VIII.

### DESCRIPTIONS OF NEW SPECIES OF FOSSILS

FROM THE

CLINTON, LOWER HELDERBERG, CHEMUNG, AND WAVERLY GROUPS, FOUND IN THE COLLECTIONS OF THE GEOLOGICAL SURVEY OF PENNSYLVANIA.

BY GEORGE B. SIMPSON.

Read before the American Philosophical Society, December 21, 1888.

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In determining the species in the collections of Messrs. Hall, Sherwood, Fellows, and others, I found a number of species which I could not reconcile with any known to me, or with any published in the books to which I had access.

Prof. James Hall, of Albany, N. Y., was kind enough to review these specimens with me, and decided that many of them were new. Of these new species nineteen are described in this paper. The eleven other species I had no opportunity to submit to him, but I have no doubt that they also are species that have not hitherto been described.

GEORGE B. SIMPSON.

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## ORTHIS PENNSYLVANICA Simpson, n. sp., Fig. 1.

Shell essentially circular, in nearly all the specimens observed, the height and width being equal; hinge line short, length equal to half the width of the shell; cardinal extremities rounded; lateral and basal margins regularly rounded, except in the middle basal margin of the ventral valve, where there is a slight constriction.

Dorsal valve somewhat gibbous, greatest convexity a little above the middle; rapidly curving to the cardinal and lateral margins; a little more gradually to the basal margins. Along the middle of the valve is a flattened or slightly depressed area, narrow at the beak, gradually growing wider, and comparatively broad at the base.

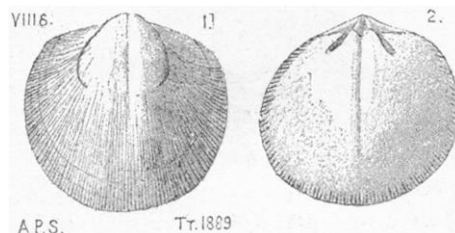
Ventral valve. A perfect specimen has not been observed, but gutta-percha casts have been taken from impressions of fragments in the rock which probably belonged to this species. The valve is flattened, or of much less convexity than the dorsal valve, with a slight elevation along the middle, corresponding to the depression of the opposite valve.

Surface marked by prominent, subangular, radiating striae, increasing by bifurcation, of uniform size at the margins, where there are twelve in the space of 5 mm.; a short distance below the beak there are twenty in the same space. The radii are crossed by fine indistinct concentric striae, which on many specimens are obsolete; also, at irregular intervals, by lines or varices of growth.

On the cast of the dorsal valve the distance from the beak to the lower margin of the muscular impression is about one-half the length of the valve. Impression ovate in outline; width equal to or very slightly less than the length, with a deep depression along the middle. On the ventral valve the impression is ovate, bilobed. The margins are distinctly lobed in four divisions. The greater portion of the specimens observed have a diameter of from 20 to 25 mm.

This species may be distinguished from *Orthis impressa*, of this formation, by its smaller size and its more circular outline; from *Orthis tioga*, by its more circular outline, less conspicuous sinus and elevation, and ovate muscular impression.

*Formation and localities.* Chemung group, Sullivan township, Tioga county; P. and E. Railroad, between Ludlow and Wetmore, and Kinzua creek near west line of McKean county; and at various other localities in Pennsylvania.



## ORTHIS SUBCIRCULA Simpson, n. sp., Fig. 2.

Shell broadly oval, nearly circular; height usually about three-fourths the width; greatest width just below the middle; cardinal line short, length less than half the

width of the shell; extremities curving outward, the lateral margins abruptly rounded, and the basal margins broadly rounded; on the ventral valve slightly constricted at the middle. Dorsal valve flattened, greatest convexity a little below the beak, gently sloping to the front and lower lateral margins, more abruptly curving to the cardinal extremities; at the middle of the base a shallow depression, which continues about one-half of the distance to the beak. Ventral valve more convex, greatest convexity about one-third the length from the beak; beak incurved and projecting beyond the area line.

Surface marked by conspicuous radiating striæ, which are sometimes of uniform size, but usually near the base there are very fine alternating striæ. The large striæ are marked at infrequent intervals by elongate pits or openings. The radiating striæ are crossed by fine, indistinct concentric striæ, and at greater intervals by distinct lines or varices of growth.

On the casts of the interior of the ventral valve the muscular impression is ovate in outline, the length equal to more than two-thirds that of the shell; width two-thirds the length; bilobed by the callosity of the adductor muscle. The sides are somewhat distinctly lobed in three divisions.

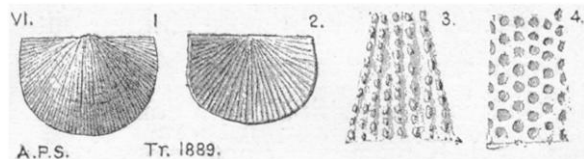
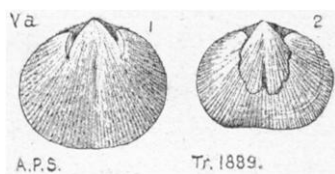
This species most closely resembles *Orthis circulus* of this formation, but the valves are unequal, the outline less circular, the greatest width being below the base, and is constricted at the base. The muscular impression is larger.

*Formation and locality.* Clinton group, above fossil ore, from McKee's ore bank, seven miles north-west of Lewistown, Mifflin county; also, ore mine north of Blacklog creek, Orbisonia, Huntingdon county, Pennsylvania.

#### CHONETES PUNCTATA Simpson, n. sp., Fig. 3.

Shell semicircular, plano-convex or concavo-convex; greatest width at about the middle of the shell; height from two-thirds to three-fourths the width; length of hinge line usually less than the width of the shell, but sometimes equal to it and occasionally greater. The cardinal extremities are rectangular, or sometimes produced in slight acute extensions, rarely rounded; lateral and dorsal margins regularly rounded.

Ventral valve, varying from moderately convex to gibbous; greatest convexity at the middle, gently curving to the beak, more rapidly to the latero-basal margins,



and abruptly towards the hinge line. At the cardinal extremities there is a flattened area 2 mm. or more in width, gradually growing narrower to the beak.

Dorsal valve, variably concave, sometimes nearly flat, at other times following the contour of the ventral valve; always with a flat area corresponding to that of the opposite valve.

Surface marked by rounded or subangular striæ, which increase by bifurcation; at the base there are four in the space of 1 mm. The radiating striæ are crossed by extremely fine concentric striæ, about twelve in the space of 1 mm., and at irregular intervals by more distinct lines of growth.

On the hinge line are evidences of eight spines, four on each side of the beak, short, slightly oblique.

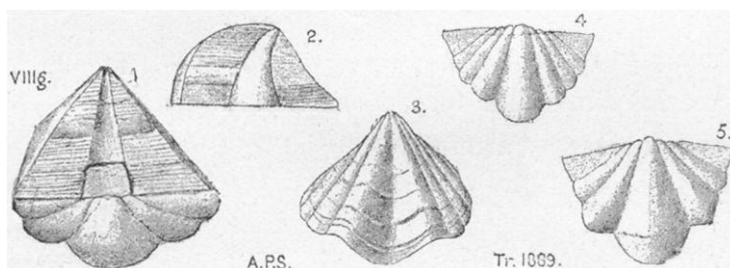
The interior of the ventral valve shows a narrow median ridge, with narrow oval ocellus muscular impressions. Corresponding to the radiating striæ of the exterior are rows of small conical nodes, the bases of which are nearly in contact. They continue nearly half way to the beak.

The impression of the interior of the ventral valve has numerous punctæ or holes, caused by the mucronate nodes of the interior; it presents a peculiar clathrate appearance, which is sufficient to distinguish it from any other species.

*Formation and locality.* Lower Helderberg group, Mansing's quarry, near Hazardville, Carbon county, Pennsylvania.

CYRTINA TRIPLICATA Simpson, n. sp., Fig. 4.

Shell more or less triangular, subpyramidal; hinge line equal to the greatest width of the shell; proportional length and width somewhat variable; length of the



dorsal valve from one-half to two-thirds the width; length of ventral valve about equal to the width; height of the area greater than the length of the dorsal valve.

Ventral valve quadrilateral, subpyramidal; most prominent at the beak, which is variable in elevation, straight, not arching over the area, usually attenuate; lateral margins regularly rounded. Mesial sinus narrow at the beak, rapidly widening as it extends forward, and becoming deep; where it reaches the margin the shell is pro-

duced in a conspicuous sublinguiform extension. Sides of the sinus flat, abruptly sloping, making the bottom angular. Area large, triangular, varying in height; sometimes nearly equal to the width of the shell, at other times not more than half the width; slightly oblique; striated in both directions; the longitudinal striæ distinct; the vertical striæ much fainter and frequently obsolete; fissure moderately narrow and closed by a convex pseudo-deltidium.

There are three or four plications on each side of the sinus, the two bounding the sinus being much more prominent than the others.

Dorsal valve semicircular or subtrigonal in outline; length from one-half to two-thirds the width. Mesial fold broad, prominent, extremely elevated in front, bounded by broader furrows than those between the plications. There are two plications on each side of the mesial fold, the two plications adjacent to the fold being much more prominent than the others; on some of the specimens nearly as prominent as the fold itself, the other two plications being obscure.

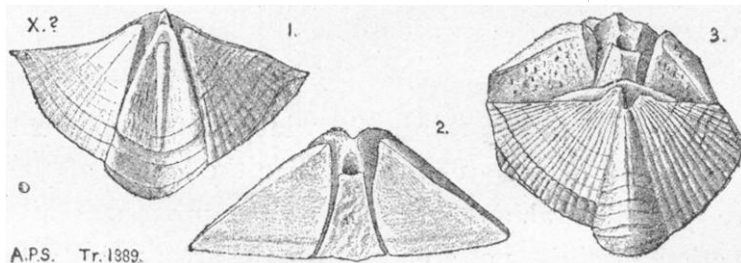
The surface of both valves is ornamented by very fine and delicate concentric striæ, which are obsolete on all but the perfectly preserved specimens. There are also more conspicuous lines of growth which are most prominent on the anterior portions of the shell.

This species most closely resembles *Cyrtina hamiltonensis*, but may be distinguished by the two prominent plications adjacent to the medial fold; this feature will serve to distinguish it from other species of the genus at present known.

*Formation and locality.* Chemung group, three miles north-west of Warren, in Warren county, Pennsylvania.

SYRINGOTHYRIS ANGULATA Simpson, n. sp., Fig. 5.

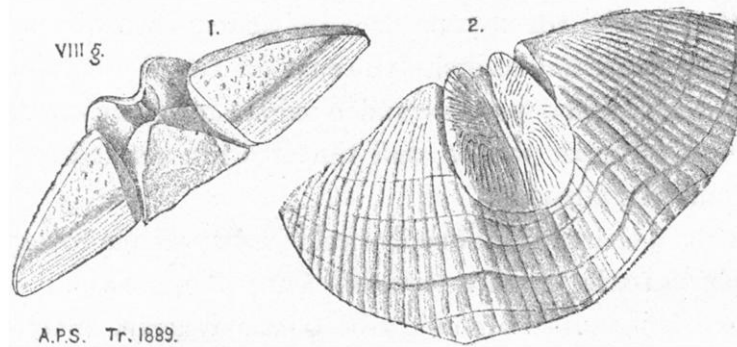
This species closely resembles *S. randalli*; but the specimens are usually of smaller size; the mesial sinus and fold proportionately narrower; the cardinal extremities angular and frequently attenuate.



*Formation and locality.* Waverly group, near Warren, Warren county, Pennsylvania.

## SYRINGOTHYRIS RANDALLI Simpson, n. sp., Fig. 6.

Shell transversely semi-elliptical or semi-circular; ventricose, becoming gibbous with age; length usually about one-half the width, but sometimes three-fourths;



hinge line straight, length equal to the greatest width of the shell. Cardinal angles more or less rounded, not attenuate.

Ventral valve with a high vertical or slightly sloping cardinal area, from the apex of which the sides of the shell curve outward to the antero-basal margins.

A median sinus begins at the beak, rapidly widening as it extends forward, and becoming deep, with abruptly sloping sides; where it reaches the margin the shell is produced in a conspicuous linguiform extension.

The deltidial aperture is covered for about one-half its length from the beak, by an arched transverse callosity or pseudo-deltidium. The edges of this callosity unite with the strong dental lamellæ, which divide the rostral portion of the shell into three chambers; and from the inner posterior surface of the callosity extends the syringothyral tube, which is unusually broad near its posterior extremity, but tapers rapidly to an open termination, sloping into the internal cavity. This tube is split for its entire length along its outer surface, and appears to have been thickened and filled in its posterior portion with the increasing age of the animal.

Dorsal valve convex, greatest convexity at about one-third the length of the shell from the beak; convex to the cardinal line, becoming somewhat flattened at the cardinal extremities; gradually curving to the lateral and basal margins. Mesial fold narrow at the beak, rapidly widening and becoming prominent below; produced at the margin corresponding to the linguiform extension of the ventral valve.

Surface of the valve ornamented by from forty to sixty costæ, which occur both on the sides and the sinus. Radiating striæ crossed by concentric striæ, which, in the specimens observed, are most conspicuous on the mesial fold and sinus. There are also lines of growth, which are usually the strongest on the anterior portion of



the shell. Horizontal lines of growth, without vertical cross lines, are conspicuously developed on the cardinal area.

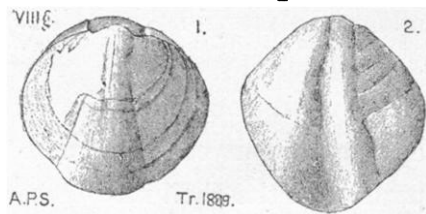
On the ventral valve the muscular scars are strongly developed, and extend over nearly two-thirds the length of the shell; ovate in outline, the width being equal to three-fourths of the length; the area being largely occupied by the cardinals, between which lie the narrow linear adductors. The casts of the dorsal valve show the marks of the deeply striated cardinal process and elongate tooth-sockets. In casts of the ventral valve the whole upper portion and the area are marked by numerous irregularly disposed prominent pustules.

From the external characters alone it would be impossible to separate this species from *Spirifera disjuncta*, but the internal differences are generic.

*Formation and locality.* Chemung group, near Warren, Warren county; and at Union City, Erie county, Pennsylvania.

MERISTELLA INCERTA Simpson, n. sp., Fig. 7.

Shell subrhomboidal, greatest width at or a little below the middle; length of the ventral valve equal to the width; of the dorsal valve, slightly less. Valves convex, the ventral valve being the most gibbous. Antero-basal margins gently curving outward, at the middle abruptly rounding and the front produced in a broad extension.



Ventral valve the more convex; greatest convexity a little above the middle, abruptly curving to the cardinal margins, and more gradually to the front. A comparatively deep, broad sinus extends from the beak to the base, forming one of the most conspicuous features of the species. Umbo prominent. The beak is broken away on the specimens observed, but enough remains to show that it was rounded, closely incurved, nearly at right angles to the plane of the axis.

Dorsal valve less convex than the opposite, greatest convexity above the middle, regularly curving to the antero-basal margins, elevated towards the base into a mesial fold, which is much less conspicuous than the corresponding depression of the ventral valve; beak small, incurved, lying below that of the opposite valve.

The general aspect of the surface is that of a smooth shell with a few strong lines or varices of growth. There are indications of radiating striæ, and it is possible that specimens in a better condition of preservation would show both radiating and concentric striæ.

The form of this species is very similar to that of *Meristella bella*, of the Lower Helderberg group, but that species has a depression on both the ventral and dorsal valves, while this species has a fold on the dorsal valve. The subrhomboidal form distinguishes it from any species of the Upper Helderberg groups.

*Formation and locality.* Chemung group, near Warren, Warren county, Pennsylvania.

RHYNCHONELLA (STENOCHISMA) LÆVIS Simpson, n. sp., Fig. 8.

Shell ovate or subtrigonal; valves subequally convex in young shells; in older shells the dorsal valve usually the most gibbous. The width is slightly less than the height; greatest width about two-thirds the length from the beak; margins from the apex to this point slightly curved outward, nearly straight, then somewhat abruptly rounding, and at the base produced in a slight extension.



Ventral valve depressed convex, slightly gibbous at about one-third the length from the apex, curving abruptly to the cardinal and antero-basal margins, more gradually to the lower lateral margins, becoming depressed in a shallow sinus, which commences at about one-third to one-half the length from the beak; beak slightly incurved, strongly projecting beyond the beak of the opposite valve.

Dorsal valve convex, greatest convexity at or a little below the middle, gradually curving to the apex and cardinal margins, more abruptly to the lateral margins; mesial fold commencing at a little above the middle and often becoming prominent at the front; beak small and nearly straight.

Surface marked by from ten to twelve rounded or subangular plications, which become obsolete on the upper portions of the valves. The mesial fold is composed of three plications much more prominent than the others. In the sinus there are three plications smaller than the others; the two plications bordering the sinus larger than those on other portions of the shell.

The specimens observed have a length of 9 or 10 mm., and a width of from 7 to 9 mm; a transverse section broadly oval, having a width of 5 or 6 mm.

This species is easily distinguished from any other of this formation at present known. The outline is very similar to some of the forms of *R. (Stenochisma) eximia*, of the Chemung group, but the shell is smaller, the plications of the fold and sinus are fewer and the plications become obsolete on the upper half of the valve.

*Formation and locality.* Clinton group, limestone, two miles south-west of Bell's mills, Blair county, Pennsylvania.

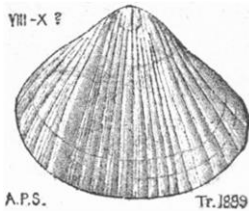
## RHYNCHONELLA MEDIALIS Simpson, n. sp., Fig. 9.

Shell broadly oval or subtrigonal in outline; height a little less than the width; greatest width about two-thirds the length of the shell from the beak. Margins from the apex to the widest portion of the shell nearly straight, then abruptly rounding and slightly produced in front in a broad extension.

Ventral valve convex at the sides, depressed in the middle; mesial sinus commencing at the apex and growing wider to the base, where it occupies fully one-half of the width of the valve.

Dorsal valve unknown.

Surface marked by about twenty plications, of which eleven occupy the mesial sinus, and are smaller than those on other portions of the valve, there being five in the same space occupied by three of the others; plications rounded or subangular. There are also very fine radiating striae covering the plications, four or five in the space of 1 mm. The plications are crossed by lines or varices of growth. No concentric striae have been observed, though they may occur on more perfectly preserved specimens.



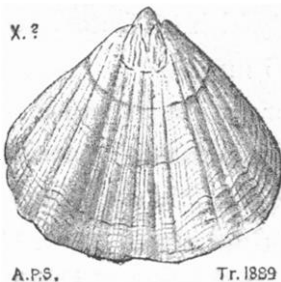
The specimen from which the above description was taken has a height of 25 mm., and a width of 30 mm.

This species is associated with *Rhynchonella* ———, but may be readily distinguished by its size and the much larger number of plications in the mesial fold. The only species approaching it in that respect is *R. (S.) venustula*, of the Hamilton group, but they are so unlike in other respects that there will be no difficulty in distinguishing them.

*Formation and locality.* Waverly group, near Warren, Warren county, Pennsylvania.

## RHYNCHONELLA STRIATA Simpson, n. sp., Fig. 10.

Only the ventral valves of this species have been observed, but they differ so much from known forms that it is necessary to consider them as belonging to a new species.



Shell subtriangular ovate, apex pointed; length and width about equal. Margins from the apex to below the middle nearly straight, broadly rounding below, and at the base produced in a broad extension.

Ventral valve convex at the sides, depressed at the middle.

Mesial sinus beginning near the apex and continuing to the base, becoming very broad as it approaches the front.

Surface marked by thirteen plications, of which five occupy the mesial sinus, the three central ones being larger than the outer ones, but all smaller than those on the other portions of the shell; plications subangular or angular. There are also very fine radiating striæ on the plications, three in the space of 1 mm. The plications are crossed by fine concentric striæ, which are most prominent on the front of the valve, becoming obsolete above, and also by stronger imbricating lines or varices of growth.

The specimens observed have a height of about 35 mm.; width just below the middle equal to the height.

This species may be distinguished from any other of this formation by its large size, deep sinus and radiating striations. This species closely resembles *Rhynchonella missouriensis* of the Kinderhook group, but the shell is larger, the apex more pointed, giving an angular appearance to the upper portion of the shell, and the greatest width is below the middle.

*Formation and locality.* Waverly group, four miles south-west of Warren, Warren county, Pennsylvania.

AVICULOPECTEN ÆQUALATA Simpson, n. sp., Fig. 11.

Shell of medium size, equilateral, not oblique, nearly circular; length a little more than the width; basal and lateral margins below the ears regularly and broadly rounded.

Left valve flattened; greatest convexity a little more than one-fourth the length of the shell from the beak; very gradually sloping to the lateral and basal margins.

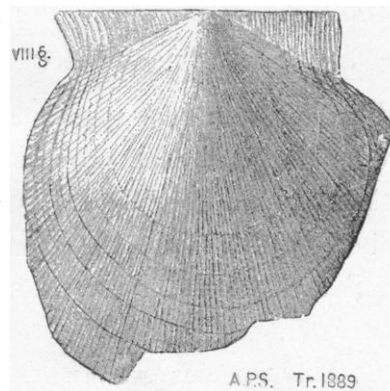
Right valve unknown.

Hinge line straight; length a little more than two-thirds the width of the shell, central, not extending as far as either lateral margin.

Beak obtuse, rounded, straight; umbo prominent, well defined by its slightly gibbous form and its rapidly sloping sides.

Ears subequal, narrow, triangular, and each separated from the body by a narrow sinus; lateral margins convex.

Surface ornamented by narrow but distinct rays of essentially uniform size; at the base there are six or seven in the space of 5 mm.; a little above the middle of the shell there are twelve in the same space; interspaces wider than the rays. The



rays are crossed by fine, concentric, crenulating striae, which become fasciculated on the anterior ear. Near the base there are frequent concentric undulations.

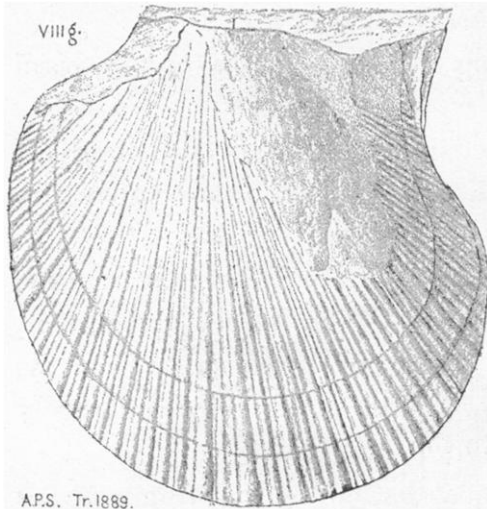
The specimen from which the description was made measures as follows: height 50 mm.; width 50 mm.; length of hinge line 35 mm.

*Formation and locality.* Chemung group, one mile north of Warren, Warren county, Pennsylvania.

LYRIOPECTEN ALTERNATUS Simpson, n. sp., Fig. 12.

Shell large, broadly ovate, nearly circular; height about equal to the longitudinal diameter; basal and lateral margins regularly rounded.

Left valve moderately convex; greatest convexity above and a little anterior to the middle, gradually sloping to the base, more abruptly curving to the cardinal and antero-basal margins.



Right valve unknown.

Hinge line straight, length a little more than one-half the transverse diameter of the valve.

Anterior ear short, triangular, not well defined; posterior ear triangular, flat; limits not well defined except near the beak; margin slightly concave, nearly straight; extremity angular.

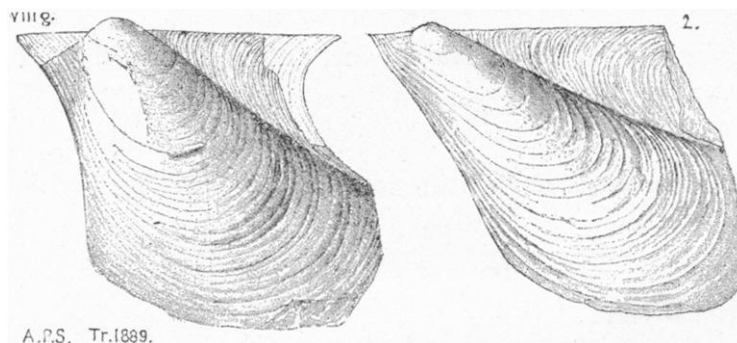
Surface marked by more than thirty comparatively strong, sharply rounded rays; between adjacent prominent rays are usually three smaller rays, the central one of which is larger than the others, occasionally nearly as prominent as the principal ones; the other two are much finer. On and near the posterior ear, and also near the anterior, this disposition is not conspicuous, the radii being more nearly of the same size. The radii are crossed by occasional lines of growth. No concentric striae have been observed.

This species somewhat resembles *Lyriopecten tricostatus* of this formation, but may be distinguished by its more nearly circular form, by the greater number of and less prominent radii, and the stronger central one of the three intermediate striae; from *L. magnificus* and *L. macrodontus* by its smaller size and the decided difference in the ornamentation of the surface.

*Formation and locality.* Chemung group, one mile north of Warren, Warren county, Pennsylvania.

## LEPTODESMA LEIOPTEROIDES Simpson, n. sp., Fig. 13.

Shell above the medium size, subrhomboidal; body elongate ovate, oblique at an angle of about fifty degrees to the hinge line; height a little less than two-thirds the



length; antebyssal margin rounded, much constricted at the byssal sinus, then broadly rounding, somewhat abruptly recurving at the postbasal extremity.

Left valve gibbous above the middle, becoming flattened on the postero-basal portion. Right valve unknown.

Hinge line straight, length unknown, as a perfect specimen has not been observed.

Beak subanterior, prominent, oblique, directed forward; umbonal region gibbous, descending more abruptly on the posterior than on the anterior side.

Anterior end short, angular at the extremity, rounded below, separated from the body by a distinct, nearly vertical byssal depression. Wing narrow, triangular, joining the body at a little more than one-third the length of the valve from the posterior extremity; margin oblique below, becoming deeply concave and abruptly curving backward, and probably produced in a spiniform extension.

Surface marked by concentric striae which are most distinct on the wing near the body, being often fine, sharp, and lamellose in appearance; frequently on the body becoming fasciculated and producing an undulated surface. The wing is separated from the body by a well-defined, narrow groove, which regularly curves inward from the beak to the junction of the wing with the body.

The specimens vary in proportional height and length; two left valves having respectively a length of 60 and 50 mm. and a height of 40 and 45 mm. The width of the body of the longer specimen at the junction of the wing with the body is 30 mm., of the shorter one 35 mm.

The specimens usually have somewhat the appearance of the genus *Leiopteria*.

Some of the specimens resemble *Leptodesma billingsi* of this formation, but may be distinguished from that species by the greater width of the lower portion of the body, the larger wing and the very distinct separation of the body and wing.

*Formation and locality.* Chemung group, near Warren, Warren county, Pennsylvania.

LEPTODESMA PARALLELUM Simpson, n. sp., Fig. 14.

Shell small, slightly oblique; body ovate; the basal margin frequently nearly parallel with the hinge line; length usually a little more than twice the height; anterior margin rounded; basal margin nearly straight, a little constricted anterior to the middle; abruptly recurving at the postero-basal extremity; the posterior margin being obliquely truncate.



Left valve convex, greatest convexity at the umbonal region, becoming flattened at the postero-basal portion.

Right valve a little more convex than the other but not gibbous.

Hinge line straight, length about three-fourths that of the shell.

Beak about one-fourth the length of the shell from the anterior end, prominent, directed forward; umbonal region convex, descending much more abruptly on the posterior than on the anterior side.

Anterior end short, angular at the extremity, rounded below. A depression extends from near the beak to the basal margin a little anterior to the middle. Wing very narrow, triangular, joining the body nearly at the posterior extremity; margin of wing straight, oblique; extremity obtusely angular. The wing is distinctly separated from the body.

Surface marked by concentric striæ, which frequently fasciculate on the anterior portion of the shell. There are also concentric undulations.

This species most closely resembles *Leptodesma propinquum*, but the wing is more distinctly separated from the body, and the body is much less oblique, the basal margin being sometimes nearly parallel with the hinge line; this latter feature will serve to distinguish it from any other species at present known. When a little covered by the rock it might easily be mistaken for some form of *Sphenotus*.

*Formation and locality.* Chemung group, hill north of Warren, Warren county, Pennsylvania.

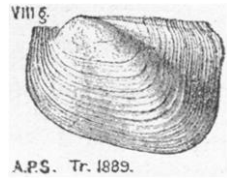
PTYCHOPTERIA OBSOLETA Simpson, n. sp., Fig. 15.

Shell of medium size, subrhomboidal in outline; body ovate oblique, at an angle of about forty degrees to the hinge line; height about three-fourths the length. Anterior margin abruptly rounded; basal margin curved outward at the extremities, concave at the middle; posterior margin somewhat abruptly recurved.

Right valve unknown. Left valve moderately convex; greatest convexity at the umbonal regions.

Hinge line essentially straight; length a little less than that of the body.

Beak situated at about the anterior fourth of the shell, small, extending beyond the hinge line. A shallow broad sinus extends from the beak to the basal margin a little anterior to the middle.



Anterior extremity acuminate, margin rounded.

Wing triangular, joining the body at the posterior extremity; margin for a short distance straight, then abruptly curving forward, and just before reaching the cardinal line curving upward. Wing convex; flattened immediately below the cardinal line; separated from the body by a narrow but conspicuous depression.

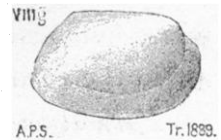
Surface ornamented by faint radiating striæ, which are obsolete, except on perfectly preserved specimens, and also by fine concentric striæ, which frequently become fasciculate on the anterior portion of the shell.

This species may be distinguished from any other at present known by the slight obliqueness of the body of the shell, the basal margin being nearly parallel with the hinge line; the margin is decidedly convex; in nearly all other species it is straight or concave; the wing extends beyond the body of the shell. The outline is very similar to that of some forms of the genus *Cypricardinia*.

*Formation and locality.* Chemung group, hill north of Warren, Warren county, Pennsylvania.

MODIOMORPHA RIGIDULA Simpson, n. sp., Fig. 16.

Shell of medium size or smaller, subquadrangular in outline; height a little more than three-fifths the length of the shell; basal margin regularly and gently curving from the anterior to the postbasal extremity; posterior margin gently curved, slightly oblique, sometimes nearly at right angles to the basal margin; cardinal line essentially straight; anterior rounded abruptly, extended, without limitation by a sinus.



Beaks a little more than one-fourth the length of the shell from the anterior end; umbonal ridge prominent, extending from the beaks to the postbasal extremity. Valves convex towards the basal margin, becoming gibbous above the middle and in the umbonal region; posterior slope convex near the beaks, becoming flattened as it approaches the posterior margin.

Surface marked by concentric striæ which frequently become obsolete on portions of the shell.



On casts of this species the pallial line is sometimes so strong as to give a distorted appearance to the specimen.

This species may be distinguished from *Modiomorpha rigida*, of this formation, by its greater gibbosity, the less oblique posterior margin, less clearly defined umbonal ridge, and the more prominent beaks.

*Formation and locality.* Chemung group, Tioga village, Tioga county, Pennsylvania.

MODIOLOPSIS SUBRHOMBOIDEA Simpson, n. sp., Fig. 17.

Shell of medium size, rhomboid ovate in outline; length twice the height; basal margin slightly convex along the middle, curving to the extremities; posterior margin abruptly rounded below, somewhat more gradually recurving to the cardinal line; cardinal margin slightly arcuate; anterior margin sharply rounded.



Valves flattened, greatest convexity at the umbonal ridge.

Hinge line slightly oblique, extending a little more than two-thirds the length of the shell.

Beaks appressed, situated about one-fourth the length of the shell from the anterior end; umbonal ridge not distinctly defined; posterior slope rounded, becoming flattened just before reaching the cardinal line.

Surface marked by fine concentric lines, and at irregular distances apart by varices of growth.

The anterior muscular impression is moderately large, well marked, and situated just within the anterior margin below the beak. The best preserved specimen has a length of 24 mm., and a height of 13 mm.

This species may be distinguished from *M. subcarinatus* by the less clearly defined umbonal ridge, the somewhat arcuate hinge line, and the absence of a constriction in the basal margin.

*Formation and locality.* Clinton shale, above fossil ore, at McKee's ore bank, north-east of McKee's house, Ferguson valley, seven miles north-west of Lewistown, Mifflin county, Pennsylvania.

GONIOPHORA CURVATA Simpson, n. sp., Fig. 18.

Shell trapezoidal, medium size or smaller; length usually about twice the height, sometimes a little less; anterior end rapidly declining from the beaks, abruptly rounded below; basal margin gently rounding, sinuate a little anterior to the middle;

posterior margin obliquely truncate; cardinal line very slightly oblique, straight; hinge line about two-thirds the length of the shell.

Valves convex below the umbonal ridge, gibbous in the umbonal region; umbonal slope flat or a little concave.

Beaks at the anterior end, acute, incurved; umbonal ridge very prominent, angular, extending from the beak to the basal extremity, curved. Along the middle of the posterior slope is a low rounded or subangular ridge, moderately conspicuous.

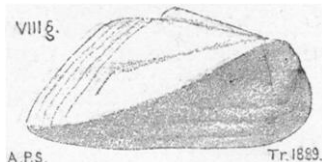
Test marked by concentric striae, which become fasciculate on that portion of the shell below the umbonal ridge. The test is raised in a crest along the umbonal ridge.

Anterior muscular impression situated at the anterior edge, ovate width two-thirds the length; pallial line near to and parallel with the basal margin, appearing as a shallow groove on the casts; posterior muscular impression not observed.

A specimen of medium size has a length of 40 mm., and a height of 18 mm. Other specimens preserve about the same proportion.

This species closely resembles *Goniophora truncata* of the Hamilton group, but the hinge line is much longer, and the posterior margin correspondingly less oblique. From *Goniophora chemungensis* it is distinguished by its smaller size, more distinctly curved umbonal ridge, and the ridge along the middle of the umbonal slope; from *G. perangula* by the less angular form of the shell, the much less oblique posterior margin, and the ridge on the posterior slope; from *G. subrecta* by its much smaller size and the ridge on the posterior slope.

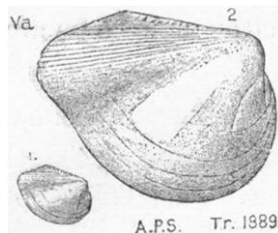
*Formation and locality.* Chemung group, near Warren, Warren county, Pennsylvania.



NUCULA SINUOSA Simpson, n. sp., Fig. 19.

Shell small, ovate cuneate in outline, subnasute behind; height varying from one-half to two-thirds the length, usually slightly more than one-half; anterior and middle portions of the basal margins rounded, somewhat abruptly constricted towards the posterior end; posterior margin obliquely truncate; anterior end abruptly rounded; cardinal line, anterior to the beak, sharply declining; more gradually sloping to the posterior.

Valves slightly convex, greatest thickness of the shell a short distance below the umbo.



Beaks from one-third to three-fifths of the length of the shell from the anterior end, extending above the hinge line, compressed, sharp, not prominent.

Umbonal ridge distinctly defined, subangular, with a shallow depression below it, which is most conspicuous at the postbasal margin, becoming obsolete on the upper half of the shell; posterior slope marked by fine, sharp, slightly divergent striae. There are also fine concentric striations, which on the specimens observed are obscure, the surface appearing smooth.

Hinge line marked by frequent crenulations.

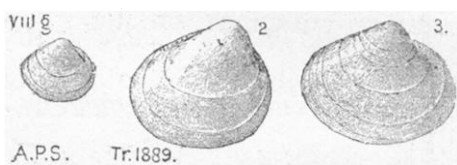
Three specimens measured have each a length of 10 mm.; height varying from 5 to 7 mm.

In the striation of the posterior slope this species resembles *Nucula poststriata*, of the Trenton and Hudson River groups, but may be distinguished from that species by its less gibbous form, the constriction of the postbasal margin, and the conspicuous depression below the umbonal ridge.

*Formation and locality.* Clinton group, McKee's ore bank, seven miles northwest of Lewistown, Mifflin county, Pennsylvania.

NUCULA SUBTRIGONA Simpson, n. sp., Fig. 20.

Shell somewhat variable in form, usually subtrigonal; length and height about equal; basal margin regularly rounded, not constricted toward the posterior end;



posterior margin rounded or obscurely truncate; anterior margin abruptly rounded; cardinal line very abruptly declining anterior to the beak, more gradually declining to the posterior.

Valves slightly convex, somewhat flattened as they approach the basal margin.

Beaks about one-third the length of the shell from the anterior end, not prominent, compressed, extending above the hinge line; umbonal ridge obscure, very slightly arching upward; posterior slope very narrow, rounded.

Surface marked by fine concentric striae and occasional varices of growth. The concentric striae are often very obscure, the shell appearing essentially smooth.

Hinge line, posterior to the beak, marked by a row of fine transverse teeth.

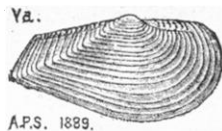
Three specimens representing the extremes in form measure respectively 10, 4 and 4 mm. in length, and 10, 3 and 2 mm. in height. Larger specimens occur.

This species may easily be distinguished from *N. sinuosa* by the absence of a constriction in the basal margin, furrow below the umbonal ridge and striae on the posterior slope.

*Formation and locality.* Chemung group, north of Blacklog creek, Orbisonia, Huntingdon county, Pennsylvania.

TELLINOMYA (PALÆONEILO) CUNEATA Simpson, n. sp., Fig. 21.

Shell small, ovate cuneate in outline; length twice the height; basal margin broadly rounding, becoming constricted or arcuate at about one-third the length of the shell from the anterior end; posterior margin short, obliquely truncated; cardinal line essentially straight, sloping at nearly the same angle anteriorly and posteriorly to the beaks; anterior end large and regularly rounded.



Greatest convexity of the valves above the middle and in the umbonal region. Beaks about central, slightly incurved, extending a little above the hinge line; umbonal ridge clearly defined, subangular; posterior slope declining regularly and abruptly to the cardinal line. Below the umbonal ridge there is a broad shallow depression, extending from near the beaks to the base and constricting the basal margin.

Surface marked by strong, lamellose, concentric striae at regular distances apart, and by very fine concentric lines between the lamellose striae.

On the specimens observed there are eight or nine transverse teeth on each side of the beak.

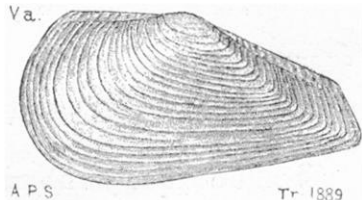
The specimens measured have a length of 12 mm., and a height of 6 mm.

This species may be distinguished from *T. (P.) diminuens* of this formation by its smaller size, more distinct lamellose striations and the less abrupt constriction of the posterior portion.

*Formation and locality.* Clinton group, seven miles north-west of Lewistown, Mifflin county; and north of Blacklog creek, Orbisonia, Huntingdon county, Pennsylvania.

TELLINOMYA (PALÆONEILO) DIMINUENS Simpson, n. sp., Fig. 22.

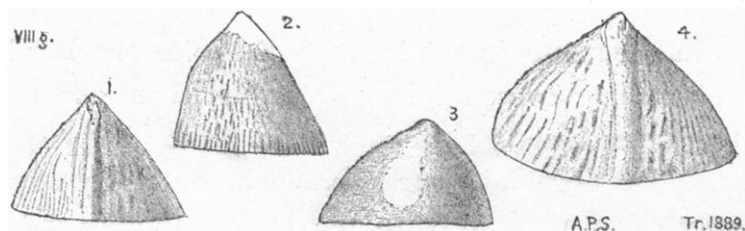
This species is very similar to the preceding, but is usually larger, the specimens observed having a length of from 23 to 25 mm., and a height of 11 or 12 mm. The posterior portion is more abruptly constricted, the lamellose striations are not so prominent and are more closely arranged.



*Formation and locality.* Clinton group, McKee's ore bank, north-east of McKee's house, Ferguson valley, seven miles north-west of Lewistown, Mifflin county, Pennsylvania.

## PLATYCERAS BREVE Simpson, n. sp., Fig. 23.

Shell of medium size, apex not incurved; body straight; rapidly increasing in size; width at the base equal to the length of the anterior side; length of the poste-



rior side from two-thirds to four-fifths that of the anterior; both sides convex; on the anterior side there is a prominent subangular elevation, commencing at the apex and continuing to the base; on each side of the carina a slight depression; other portions of the shell without plications or elevations.

Aperture circular; peristome, as far as can be ascertained, not sinuous.

Surface marked by elongate pustules, subregularly arranged, giving to the surface the appearance of being coarsely striated, three in the space of 5 mm. There are also faint indications of concentric striæ.

A specimen of average size measures as follows: Diameter of aperture 23 mm.; length of the anterior side 20 mm.; of posterior 15 mm.; height 15 mm.

The characteristics of this species are the short conical form, the rapid enlargement from the apex to the base, and the elongate pustules of the surface.

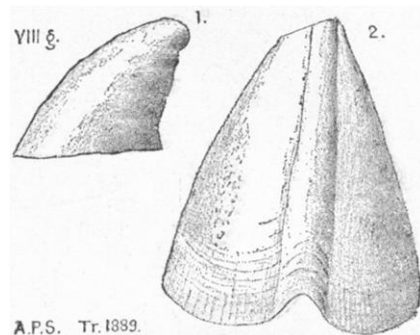
From those species having a carina it is distinguished as follows: From *Platyceras carinatum* by its conical form, the straight apex, the absence of plications and the non-sinuosity of the peristome; from *Platyceras mitelliforme* by its larger size, conical form and the ornamentation of the surface; from *Platyceras conicum* by its shorter form and the absence of conspicuous plications and the consequent non-sinuosity of the peristome. It most closely resembles *Platyceras dorsale* of this formation, but it is shorter, much less oblique; posterior side straight or convex; the apex more central and does not project beyond the base, while in that species the apex projects beyond the base a distance nearly equal to half the diameter of the aperture.

*Formation and locality.* Chemung group, near Warren, Warren county, Pennsylvania.

## PLATYCERAS DORSALE Simpson, n. sp., Fig. 24.

Shell obliquely subconical; anterior side curved; posterior straight or concave; apex not incurved, laterally compressed; body of the shell regularly increasing in

size, rounded; width at the base equal to three-fourths of the length of the anterior side; length of the posterior side one-half that of the anterior; right and left side usually equally developed, but on one specimen the right side has a little the greater development. On the anterior side there is a conspicuous rounded or subangular elevation extending from the apex to the base; on the posterior side is an elevation beginning at about one-half the length of the side from the apex, and continuing to the margin; on each side of this elevation a comparatively broad shallow depression, of the same extent as the elevation.



Aperture circular; peristome slightly sinuous at the elevations.

Surface marked by fine radiating lines; at the base there are three in the space of 1 mm., above they are much more closely disposed; the radii are crossed by fine concentric striæ; the surface presenting a cancellated appearance when the specimen is well preserved.

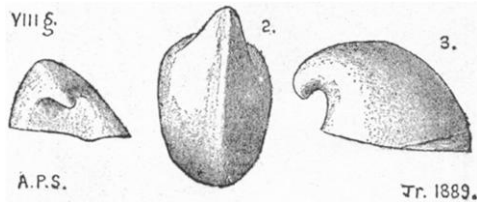
One specimen measures as follows: Length of the anterior side 32 mm., of posterior 18 mm., height of shell 18 mm. Another specimen, which probably belongs to the same species, is flattened, but that may be due to pressure; it measures as follows: Length of the anterior side 45 mm., of the posterior 22 mm., width at the base 35 mm.; height of shell 18 mm.

This species most closely resembles *Platyceras breve* of the same locality, but the anterior side is much longer and the posterior side proportionally shorter, the shell more oblique and not so regularly conical; it has an elevation and two depressions on the posterior side, and the surface has fine radiating striæ, the surface of *P. breve* being marked by elongate pustules; from *Platyceras striatum* it may be distinguished as follows: It is more oblique, the posterior and anterior sides are more unequal, and it is without the conspicuous plications characteristic of that species. It resembles *Platyceras mitelliforme* in having a prominent carina, but it is a larger form and the apex is not bent or incurved. From *Platyceras conicum* it may be distinguished by the absence of conspicuous plications; and from *P. carinatum* by the straight apex and the absence of conspicuous plications.

*Formation and locality.* Chemung group, three miles north-west of Warren, Warren county, Pennsylvania.

## PLATYCERAS INÆQUALE Simpson, n. sp., Fig. 25.

Shell small, subangularly ovate; apex minute, incurved, making less than one turn, very thin and angular; inclined or twisted to the right. The body of the shell



expands rapidly; anterior side curved, sometimes forming nearly half a circle; posterior side also curved, but in a lesser degree; width of base from one-half to three-fourths the length of the anterior side; posterior side one-third the length of the anterior.

The left side is flattened or only very slightly convex, and is often nearly or quite at right angles to the base, making a sharp angle or ridge between the side and the back of the shell. The right side is convex and much more developed than the left. In front the shell becomes flattened near the margin. On the left side, about half way between the base and angular carina, there is a low rounded ridge, commencing near the apex and continuing the length of the shell, though this feature in many of the specimens is obscure.

Aperture circular or broadly oval.

Most of the specimens observed are casts or macerated so that the surface characters are obsolete. On some of the specimens there are evidences of strong radiating striæ or elongate pustules, and when well preserved there are numerous concentric striæ.

The characteristics of this species are the pinched appearance of the apical portion, and its inclination to the right, and the much greater development of the right side; in the latter feature it resembles *Platyceras cymbeum*, but it is a much smaller shell, and the plications are very much less prominent; from *Platyceras mitelliforme* it may be distinguished by the inequality of its sides, in that species the prominent ridge being in the middle of the shell, both sides being equally developed.

*Formation and locality.* Chemung group, four miles north-west of Warren, Warren county, Pennsylvania.

## PLATYCERAS MITELLIFORME Simpson, n. sp., Fig. 26.

Shell small, obliquely arcuate from the base; apex incurved, making part of one volution; below which the body volution rapidly increases in size. Width at the base equal to three-fourths the length of the anterior side; length of the posterior side less than one-half of the anterior; right and left sides equally developed.

Anterior side convex, with a prominent, broad, rounded carina along the middle;

on each side of the carina, towards the base, a shallow depression. On some of the specimens there are indications of very slight plications on the posterior side.

Aperture oblique, broadly elliptical; peristome a little sinuous at the carina, and sometimes slightly sinuous, corresponding with the faint folds of the posterior side.

Surface marked by concentric lines and by broad undulations, which sometimes give to portions of the shell a lobed appearance.

A specimen of about the average size measures as follows: Height 12 mm.; length of the anterior side 25 mm.; of the posterior 8 mm.; width at base 22 mm.; thickness 18 mm.

The characteristic feature of this species is the prominent carina or elevation along the dorsum.

It may be distinguished from *Platyceras inaequale* of this formation by its somewhat larger size, the prominent carina, and the equal development of the right and left side; from *Platyceras dorsale* by its smaller size, its flattened form (a transverse section being oval), and by the partial volution of the apex; from *Platyceras (Orthonychia) striatum* by its arcuate form, the prominent carina and the absence of conspicuous plications; from *Platyceras carinatum* by the equal development of the right and left sides, and the absence of conspicuous plications; from other species at present known, by its small size, decidedly curved form, and prominent carina.

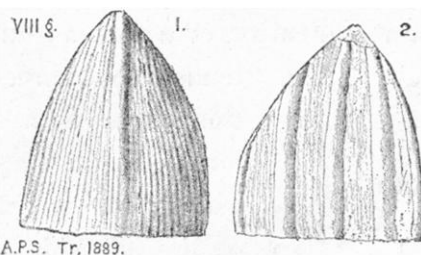
*Formation and locality.* Chemung group, near Warren, Warren county, Pennsylvania.



PLATYCERAS STRIATUM Simpson, n. sp., Fig. 27.

Shell subconical; apex not incurved or bent; body essentially straight; sides a little curved from the base to the apex; right and left sides equally developed; width at the base, length of anterior and posterior sides equal. On the anterior side is a narrow, angular, conspicuous carina, extending from the apex to the base; on the posterior side are three oblique, broad, prominent, rounded ridges, with depressions between them, which are wider than the ridges.

Aperture oval. The bases of all the specimens observed are attached to the rock so that the form of the peristome can not be definitely ascertained.





Surface marked by comparatively strong, radiating striæ, which are sometimes continuous, at other times interrupted, then having the appearance of very elongate pustules; at the base about six in the space of 5 mm. No concentric striæ have been observed, though it is possible that they exist on more perfectly preserved specimens.

A typical specimen measures as follows: Width at the base 30 mm.; thickness 20 mm.; height 30 mm.; width of sides equal; width of ridges on posterior side 3 mm.; of depressions slightly more; of carina 3 mm.

This form resembles the two specimens which are figured in the Pal. of New York, Vol. V, Pt. II, Pl. I, Figs. 20-23, which differ materially from the other figured specimens placed under that species. The other specimens, though perfectly preserved and showing concentric striæ, have no indication of radiating striæ, while in the specimens described they are one of the most characteristic features; they are also shown in the figures mentioned above. The plications are also stronger and the form more regularly conical.

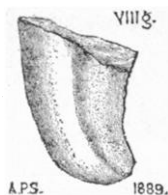
This species resembles *P. striatum* from this formation, but may be easily distinguished by its straight form, the equal length of the sides, the coarser striations, and the strong plications of the posterior sides; from *P. breve* it is distinguished by its more elongate form, oval aperture, more continuous radiating striæ, and the conspicuous plications of the posterior side.

*Formation and locality.* Chemung group, four miles north-west of Warren, Warren county, Pennsylvania.

PLATYCERAS VARIANS Simpson, n. sp., Fig. 28.

Shell small, subconical, curved, slightly oblique; apex not incurved or bent; width at the base two-thirds the length of the anterior side, and about equal to the posterior.

Plications frequent, variable in number. On the dorsum there is sometimes a faint indication of a carina; on the left side is a deep conspicuous furrow, which extends about three-fourths the length of the shell from the base; beyond this there is a slighter furrow; the area between them elevated, rounded and very prominent. On the posterior side of the shell are usually two or three slight furrows, but occasionally a stronger one, and on the left side there is one nearly as strong as on the opposite side. Sometimes on the posterior side the area between two of the smaller furrows is elevated, having the appearance of a ridge or carina, which is occasionally prominent.



The deep furrows on the right and left sides of the shell appear to be constant features, the others are somewhat variable.

Aperture broadly oval, nearly circular; peristome concealed on all the specimens observed, so that its true form can not be ascertained.

All the specimens occurring in the form of casts, the surface markings are obsolete.

This species may be distinguished from *Platyceras mitelliformis* by its straighter form, absence of a prominent carina, and by its conspicuous plications; from *P. (O.) striatum* by its smaller size, more frequent plications, and the absence of radiating striæ, the convexity of the anterior side and the concavity of the posterior; from *Platyceras inaequale* by its equally developed right and left sides and its conspicuous plications; from *P. (O.) breve* by its curved, more slender form, and plications; from *Platyceras dorsale* by its smaller size and conspicuous plications; from *P. (O.) attenuatum* by the straight apex and the strong lateral furrows; from *Platyceras carinatum* by the absence of a prominent carina and by the conspicuous lateral furrows; from *P. (O.) conicum* by its smaller size and curved form.

*Formation and locality.* Chemung group, four miles north-west of Warren, Warren county, Pennsylvania.

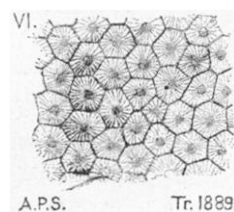
ACERVULARIA COMMUNIS Simpson, n. sp., Fig. 29.

Growing in large convex or globular masses; under side covered by a wrinkled epithecal crust. Stems multiplying by gemmation from the calyces; usually in contact, but sometimes free and circular.

Calyces in contact, polygonal, generally pentagonal or hexagonal; surrounded by acute, linear, crested edges; diameter a little variable, but usually about 5 mm. Sides of calyces abruptly curved downward to the central cavity.

Rays thin, sharp; about thirty in number; alternately long and short, but of uniform size at the margins of the calyces. Diaphragms thin.

*Formation and locality.* Lower Helderberg group, from A. B. Miller's farm, Warrior ridge, Barree township, Huntingdon county, Pennsylvania.



CLADOPORA RECTILINEATA Simpson, n. sp., Fig. 30.

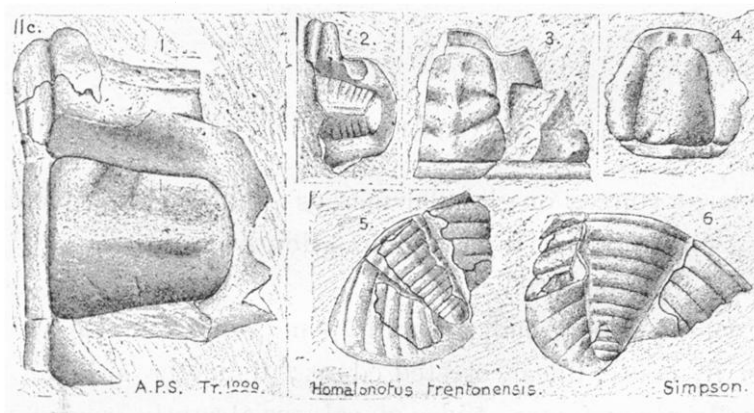
Zoarium ramose, bifurcating, rarely anastomosing; diameter of branches from 1.50 to 3 mm.

Cells tubular, nearly at right angles to the axis; rapidly increasing in size to the aperture; apertures arranged in regular longitudinal rows, which are sometimes separated by a slight ridge; from five to nine rows on a branch; from eight to ten apertures in the space of 5 mm. longitudinally; diameter of an aperture from .33 to .40 mm. Lips prominent, in well-preserved specimens, projecting over the aperture, and giving to the cell-tubes the appearance of opening very obliquely.

This species somewhat resembles *C. multipora*, but the branches are smaller and straighter, and the cell apertures are much more regularly arranged in parallel, longitudinal rows; in its size and manner of growth it is very similar to *C. macrophora*, but the surface of that species has not been observed, so no comparisons are possible.

*Formation and localities.* Lower Helderberg group, one and a-half miles south of Rock Hill furnace, Orbisonia, Huntingdon county; also north of Tyrone City, Blair county, Pennsylvania.

HOMALONOTUS TRENTONENSIS, Simpson, n. sp., Fig. 31.



The figures represent a few of many specimens in the State Collection, found by Mr. C. E. Hall in strata of the Trenton group, cropping out just above the milldam at Reedsville, in Mifflin county, Pennsylvania.